

ALTERNATIVE AND RENEWABLE FUEL AND VEHICLE  
TECHNOLOGY PROGRAM  
**FINAL PROJECT REPORT**

**SOUTH COAST AIR  
QUALITY MANAGEMENT  
DISTRICT'S HEAVY-DUTY  
NATURAL GAS DRAYAGE  
REPLACEMENT PROGRAM**



Source: Port of Los Angeles

**California Energy Commission**

Gavin Newsom, Governor

January 2019 | CEC-600-2019-004



**Prepared by:**  
South Coast Air Quality Management District

**Primary Author(s):**  
Vicki White  
Mei Wang  
Fred Minassian

21865 Copley Drive  
Diamond Bar, CA 91765

**Agreement Number:** ARV-09-002

**Prepared for:**

**California Energy Commission**

Donald Coe  
**Agreement Manager**

Elizabeth John  
**Office Manager**  
**Advanced Fuel Production Office**

Kevin Barker  
**Deputy Director**  
**Fuels and Transportation Division**

Drew Bohan  
**Executive Director**

#### **DISCLAIMER**

Staff members of the California Energy Commission prepared this report. As such, it does not necessarily represent the views of the Energy Commission, its employees, or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the Energy Commission nor has the Commission passed upon the accuracy or adequacy of the information in this report.

## PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVT Program). The statute, subsequently amended by AB 109 (Núñez, Chapter 313, Statutes of 2008), authorizes the California Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. The Energy Commission has an annual program budget of about \$100 million and provides financial support for projects that:

- Develop and improve alternative and renewable low-carbon fuels.
- Enhance alternative and renewable fuels for existing and developing engine technologies.
- Produce alternative and renewable low-carbon fuels in California.
- Decrease, on a full fuel-cycle basis, the overall impact and carbon footprint of alternative and renewable fuels and increase sustainability.
- Expand fuel infrastructure, fueling stations, and equipment.
- Improve light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets.
- Expand infrastructure connected with existing fleets, public transit, and transportation corridors.
- Establish workforce training programs, conduct public education and promotion, and create technology centers.

The Energy Commission issued solicitation PON-08-010 to provide funding opportunities under the ARFVT Program for projects which have been awarded funding from the U.S. Department of Energy under a federal funding opportunity announcement for specified transportation projects. For projects to be eligible for funding under PON-08-010, the projects must also be consistent with the Energy Commission's ARFVT Investment Plan, updated annually. In response to PON-08-010, the South Coast Air Quality Management District submitted application number 70 for \$5.051 million, which was proposed for funding in the Energy Commission's Notice of Proposed Awards as revised on March 18, 2010. The agreement was executed as ARV-09-002 on October 7, 2010. Staff completed and closed the project March 1, 2014.

## ABSTRACT

The purpose of this report is to document the implementation and results of the South Coast Air Quality Management District's Heavy-Duty Natural Gas Drayage Truck Replacement Project approved by the California Energy Commission at the May 5, 2010, business meeting. This project was intended to reduce emissions by replacing older, heavy-duty diesel trucks used for goods movement with new, natural gas vehicles. In the South Coast Air Basin, diesel air pollution from goods movement operations greatly impacts the health of community residents. The South Coast Air Quality Management District has identified these communities as environmental justice areas and is committed to supporting all feasible actions to ensure localized reductions in diesel air pollution. This project was initiated as a strategy to reduce diesel air pollution from goods movement operations.

The project offered a financial incentive in the form of a grant to drayage and other goods movement truck owners for the purchase of a new, natural gas vehicle. Due to the higher cost of a new, natural gas truck compared to a conventional diesel truck, a financial incentive was needed to encourage and accelerate the deployment of these alternative fueled vehicles.

The project resulted in the deployment of 132 new, heavy-duty natural gas trucks certified to the cleanest emission standards in California. Each natural gas truck served as a replacement vehicle for an older, high polluting diesel truck. The older diesel trucks were removed from service and dismantled (scrapped) to ensure they would not be resold or reused. The project has met all objectives, including but not limited to: increased use of alternative fuel vehicles, reduced consumption of diesel fuel, reductions in nitrogen oxides and diesel particulate matter emissions, reduced health risks from diesel air pollution, reduced greenhouse gas emissions, and increased end-user knowledge and acceptance of alternative fuel vehicles.

**Keywords:** Natural gas. Compressed natural gas. Liquefied natural gas.

Please use the following citation for this report:

Vicki White, Mei Wang, Fred Minassian. South Coast Air Quality Management District. 2019. *South Coast Air Quality Management District's Heavy-Duty Natural Gas Drayage Truck Replacement Project*. California Energy Commission. Publication Number: CEC-600-2019-004.

# TABLE OF CONTENTS

PREFACE.....	i
ABSTRACT .....	ii
Table of Contents.....	iii
EXECUTIVE SUMMARY .....	1
CHAPTER 1: .....	3
Background.....	3
1.1 Need for Funding.....	3
1.2 Purpose.....	3
1.3 Approach .....	4
1.4 Goals and Objectives .....	4
1.5 Funding Sources.....	5
CHAPTER 2 .....	6
Implementation .....	6
2.1 Outreach, Solicitation and Evaluation .....	6
2.2 Data Collection and Analysis .....	8
2.3 Results .....	9
Table 2: Estimated Amount of Diesel Fuel Displaced .....	9
Table 3: Emission Reduction Benefits .....	10
CHAPTER 3 .....	11
Summary .....	11
CHAPTER 4 .....	12
Conclusions and Lessons Learned.....	12
Acronyms.....	13
APPENDIX A.....	14
Methodology for Estimating Diesel Gallon Equivalent Replaced by CEC Funded Natural Gas Trucks .....	14
Figure 1: Daily Gate Moves.....	14
Figure 2: Proposed Fuel Economy Values for HHDDT Operating in California.....	15
APPENDIX B .....	1
List of Heavy-Duty Natural Gas Trucks Funded by this Project .....	1

## EXECUTIVE SUMMARY

In the South Coast Air Basin, diesel air pollution from goods movement operations greatly impacts the health of community residents, particularly those living near the ports, rail yard facilities, and distribution centers or along roadways with high truck traffic. The South Coast Air Quality Management District has identified these communities as environmental justice areas and is committed to supporting all feasible actions to ensure localized reductions in diesel air pollution. This project was initiated as a strategy to reduce diesel air pollution from goods movement operations.

The purpose of the project is to increase the use of alternative fuel vehicles and reduce emissions from heavy-duty diesel trucks used for goods movement. The total grant award was \$5,142,000, while South Coast AQMD and its project partners contributed \$19,440,000 in total match funding. The U.S. Department of Energy was one of the funding partners via the American Recovery and Reinvestment Act, or ARRA. The U.S. Environmental Protection Agency and the California Air Resources Board also co-funded the project. The project resulted in the deployment of 132 heavy-duty natural gas vehicles for drayage or other goods movement services in the region. Each natural gas truck served as a replacement vehicle for an older, high polluting diesel truck. The older diesel trucks were removed from service and dismantled (scrapped) to ensure they would not be resold or reused. The Energy Commission funding provided an average of \$37,000 in incremental cost funding for the new natural gas trucks, whose final costs ranged from \$142,440 to \$232,256, depending on the manufacturing, natural gas tank configuration and final customer preferences. The natural gas vehicles were deployed between February 2011 and August 2013. Based on the cumulative miles driven by the natural gas vehicles from the deployment dates through December 31, 2013, the cumulative amount of diesel fuel displaced was estimated at 1,351,682 gallons. These natural gas trucks are expected to continue to operate for additional years beyond December 31, 2013. The project will continue to provide diesel fuel displacement benefits for the life of each natural gas truck, which is expected to be about 10 years or 500,000 miles.

The project has also achieved air quality benefits in areas that are most heavily impacted by goods movement operations. The heavy-duty diesel trucks replaced by this project were used to haul freight in/out of the Ports of Los Angeles and Long Beach, rail yard facilities and/or along the major trade corridor in the region (LA/Inland Empire). The replacement of the older diesel trucks with natural gas vehicles resulted in reduced diesel air pollution. The annual oxides of nitrogen (NO<sub>x</sub>) and particulate matter (PM<sub>10</sub>) emission reduction benefits from this project are estimated to be 114 and 4.6 tons per year, respectively. The project also achieved co-benefits in the reduction of greenhouse gas emissions.

Finally, this project demonstrated that natural gas is a viable fuel for heavy-duty trucks and can be used as a cleaner, domestically produced alternative to diesel fuel. The grant

funds offered a sufficient incentive to truck owners/operators helping to overcome a market barrier for deployment.

# CHAPTER 1:

---

## Background

### 1.1 Need for Funding

The South Coast Air Quality Management District's (SCAQMD) Heavy-Duty Natural Gas Drayage Truck Replacement Program was initiated to address a significant need to reduce diesel emissions and associated public health risks from goods movement at the Ports of Los Angeles and Long Beach. The two ports, located adjacent to one another, constitute America's largest port complex and are ranked among the busiest container ports in the world. In 2010, the two ports processed over \$293 billion worth in goods which included the transfer of more than 11 million twenty-foot equivalent (TEU) containers through these facilities. This translates to more than 10,000 heavy-duty trucks each year. The two ports represent the largest source of diesel emissions in the region. Studies by the California Air Resources Board and SCAQMD have linked diesel emissions from the ports to very high levels of cancer risks to people living near the ports. SCAQMD has identified these communities as environmental justice areas and are committed to supporting all feasible actions to ensure localized reductions in diesel particulate matter exposure to people in these areas.

Early efforts started in June 2008 with a pilot project involving the replacement of 263 older, in-use diesel trucks with new, low-emission natural gas trucks. Funding partners included the United States Environmental Protection Agency (U.S. EPA), California Air Resources Board and SCAQMD's Clean Fuels Program. The pilot project was designed to provide a sufficient incentive to fleet owners to purchase a new, low-emission natural gas truck instead of a conventional diesel truck. To be eligible for the grant, the owner had to scrap an older, in-use diesel truck and replace it with the natural gas vehicle. The pilot project was used to generate interest among fleet owners, test out the program's design and assess the demand for additional grant funding. It proved successful and resulted in a significant demand for additional program funding. Subsequently, SCAQMD was awarded additional funding from the Department of Energy (DOE), California Energy Commission, California Air Resources Board, and the Ports of Los Angeles and Long Beach to expand the program and deploy more natural gas vehicles.

### 1.2 Purpose

The purpose of this project is to reduce emissions by replacing up to 180 older, heavy-duty diesel trucks used for goods movement with new natural gas vehicles. The natural gas vehicles will be deployed for service in areas that are heavily impacted by goods movement operations, including the ports, rail yards, distribution centers and major roadways with high truck traffic. The project is expected to displace diesel fuel consumption and reduce diesel air pollution and associated health risks. The project will also reduce greenhouse gas emissions through the use of a lower carbon containing



fuel. Indirect benefits from the project include but are not limited to: job preservation/creation and increasing end-user knowledge and acceptance of alternative fuel vehicles.

### **1.3 Approach**

This project was designed as an incentive-based program for fleet owners of heavy-duty diesel trucks currently performing drayage and/or other goods movement services in the South Coast Air Basin. The project provided funding in the form of a grant to qualifying fleet owners to help reduce the cost of purchasing a natural gas truck. Since the cost of a new, heavy-duty natural gas truck is almost double that of a conventional diesel truck, a financial incentive was needed to encourage and accelerate the deployment of these alternative fueled vehicles. To qualify for funding, applicants were required to be the owner of an older diesel truck (engine model year 2003 or older) that was currently in-use performing goods movement services in the region. The funds would be used to replace the older diesel truck with a new, natural gas truck certified by the California Air Resources Board at or below the cleanest emission standards in California.

SCAQMD solicited applications from truck owners (or dealerships representing the truck owners) through program announcements and evaluated applications consistent with the Proposition 1B – Goods Movement Emission Reduction Program Guidelines (Guidelines). A competitive rank list was developed and used to select projects for funding. The ranking level was determined based on a formula in the Guidelines taking into account the NO<sub>x</sub> and PM emission reductions expected from the project and the project's overall cost effectiveness (i.e., total reductions per the amount of grant funds requested).

SCAQMD selected projects in rank order and entered into contract agreements with the owners to ensure project implementation as required. SCAQMD inspected both the old diesel truck and the new, natural gas truck to ensure the equipment met the engine and vehicle specifications in the contract. Following deployment of the natural gas vehicles, SCAQMD monitored the performance of the vehicles through quarterly reporting.

### **1.4 Goals and Objectives**

The primary goals of this project are to reduce diesel air pollution, including greenhouse gas emissions, and dependency on imported petroleum fuels through replacement of up to 180 heavy-duty diesel drayage and other goods movement trucks with new, natural gas vehicles.

The objectives of this project are to: 1) increase the use of alternative fuel vehicles as a means to reduce the nation's dependence on imported petroleum fuels, 2) reduce NO<sub>x</sub> and PM emissions from heavy-duty diesel trucks and cancer risk from diesel air pollution, 3) reduce greenhouse gas emissions by using a lower carbon containing fuel, 4) provide outreach and training on alternative fuel vehicles, and 5) increase end-user knowledge and acceptance of alternative fuel vehicles. This project is also expected to

result in indirect benefits such as: job creation and/or preservation, including creation or expansion of specialized jobs in alternative fuels and/or alternative fuel vehicle education, maintenance, repair and safety inspection, and the creation of an atmosphere of competition among natural gas vehicle manufacturers to expedite the deployment of advanced low-emission alternative fuel vehicles.

### **1.5 Funding Sources**

The project received funding from the California Energy Commission, U.S. Department of Energy through the American Recovery and Reinvestment Act (ARRA), California Air Resources Board, and the Ports of Los Angeles and Long Beach. The California Energy Commission approved the project in March 2010, with an award of \$5,142,000.

# CHAPTER 2

---

## Implementation

### 2.1 Outreach, Solicitation and Evaluation

SCAQMD conducted extensive outreach to fleets, including independent owners/operators, and held informational workshops and meetings with truck dealerships, vehicle manufacturers, and lenders to support the participation of both large and small fleets involved in goods movement. To eliminate the language barrier for some truck owners/operators, the SCAQMD provided foreign language speakers and translation services at the workshops.

SCAQMD solicited applications, evaluated all applications received and verified eligibility by conducting inspections of the old diesel trucks and new natural gas vehicles to ensure the program requirements were met before payment of the grant funds. SCAQMD collected destruction documents from dismantlers to verify the old diesel trucks were permanently removed from service and destroyed. During the deployment period, SCAQMD monitored the use of the natural gas trucks through collection of quarterly reports from the fleet owners. The quarterly reports requested vehicle usage information, such as odometer readings and the amount of fuel consumed.

A total of 132 natural gas vehicles were deployed as a result of this project. The natural gas trucks were manufactured by Freightliner, Kenworth, Peterbilt, and Sterling and are equipped with Cummins-Westport natural gas engines certified at or below the cleanest emission standards in California. As shown in Table 1, the Freightliner M2-112 with LNG fuel tanks was the most-requested tractor with 69 units purchased and deployed. Costs for this configuration ranged from \$142,440 to \$166,455, depending on customer preferences. Twenty-six units of the Kenworth T-440 with LNG fuel tanks were purchased and deployed, with costs averaging about \$160,000 per unit. In nearly all purchases the Energy Commission co-funding was \$37,000 per unit. See Appendix B for the full delineation of all 132 trucks.

**Figure 1: Class 8 Heavy-Duty Natural Gas Truck**



Source: South Coast Air Quality Management District

**Table 1: Project Cost and Funding by Truck Manufacturer**

Truck Make	Model	Fuel Configuration	Total Tractor Cost <sup>1</sup> (per unit)	CEC Funding (per unit)	Total Units
Freightliner	M2	CNG	\$164,626	\$37,000	6
	M2-112	LNG	\$166,455 or \$142,440	\$37,000	69
	FLD	LNG	\$146,221	\$45,000	3
Kenworth	T400	CNG	\$200,085	\$37,000	2
	T800	CNG	\$223,376	\$37,000	4
	T8	LNG	\$232,256	\$37,000	15

	T-440	LNG	~\$160,000	\$37,000	26
	T-800	LNG	\$164,959	\$37,000	1
	Cascadia	LNG	\$146,221	\$27,000	1
Peterbilt	384	CNG	\$168,169	\$37,000	1
	384	LNG	\$152,974	\$37,000	3
Sterling	LT 8500	LNG	\$134,595	\$37,000	1
<b>Total</b>					<b>132</b>

Table Note: Final tractor cost varied widely by customer preferences and whether CNG or LNG fueling was specified. LNG tanks tend to be more expensive. The Freightliner M2-112 LNG tractors came in at 2 price points.

Source: Energy Commission Staff based on Appendix B

## 2.2 Data Collection and Analysis

As required by the program, SCAQMD collected quarterly reports from the fleet owners to monitor the usage of the natural gas trucks. The vehicle data include odometer readings, accrued mileage, fuel consumption and other information documenting performance of the vehicle. To estimate the amount of diesel fuel displaced, the odometer readings and mileage data were found to be the most reliable source of information. The fuel consumption data were incomplete, inaccurate and/or unreliable in many cases. Fuel receipts were problematic for the following main reasons: no vehicle identifier on the fuel receipt, inconsistent unit of measure for liquefied natural gas (LNG) fuel dispensed (some facilities report in units of LNG gallons while others in diesel gallons equivalent), and situations of missing/lost receipts resulting in the reporting of lower fuel consumption values. The driver-supplied odometer readings and the odometer reading recorded by SCAQMD at the time of the natural gas vehicle inspection were found to be the most reliable data for estimating the amount of diesel fuel displaced. SCAQMD found only a few drivers that reported odometer readings in error. These were drivers that inadvertently included the tenths of a mile without the decimal point or simply recorded a wrong number. SCAQMD contacted these fleet owners for verification and/or corrections. The methodology for estimating the total amount of diesel fuel displaced by this project can be found in Appendix A.

The emission reductions from this project were estimated using the California Air Resources Board's Truck Emission Benefits Calculator for the Proposition 1B - Goods Movement Emission Reduction Program (Year 2, Ver. 091511). This calculator relies on a mileage-based calculation to estimate the emission reduction benefits from each truck replacement project. The emission factors are derived from in-use testing results from heavy-duty diesel trucks operated in California. The calculator is used by CARB and

local agencies to generate a priority rank list for funding through the Proposition 1B – Goods Movement Emission Reduction Program in California. Projects that achieve the greatest emission reductions and cost effectiveness (i.e., total reductions per grant \$ invested) are given the highest order of priority. For this project, SCAQMD used mileage and other truck/engine information provided by fleet owners as input into the calculator to estimate the NOx and PM10 emission reductions and generate a rank list for funding consideration in order of priority.

## 2.3 Results

The project has met all of the specified objectives. The project resulted in the deployment of 132 natural gas trucks (Appendix B). These vehicles were deployed starting in February 2011 through August 2013 and were fueled exclusively with natural gas. The natural gas engines were certified at or below the cleanest emission standards in California. The cost of each natural gas truck and the amount of CEC grant funds applied is identified in Appendix B.

Based on an analysis of the mileage traveled by each natural gas truck from the deployment dates to December 31, 2013, the estimated amount of diesel fuel displaced by the project during the monitoring period is identified in Table 2.

**Table 2: Estimated Amount of Diesel Fuel Displaced**

<b>Project Description</b>	<b>No. of Trucks</b>	<b>Cumulative Mileage Traveled (miles)</b>	<b>Cumulative Diesel Fuel Displaced (gallons)</b>
Heavy-Duty Natural Gas Trucks (GVWR >33,000 lbs)	132	8,110,090	1,351,682

Source: South Coast Air Quality Management District staff calculations.

The natural gas trucks will continue to operate for additional years beyond December 31, 2013. The expected life of a heavy-duty natural gas truck is about 10 years or 500,000 miles<sup>1</sup>. The project will continue to provide diesel fuel displacement benefits for the life of each natural gas truck.

The project has also achieved air quality benefits particularly in regional areas that are most heavily impacted by diesel air pollution. The heavy-duty diesel trucks replaced by this project were used to haul freight in/out of the Ports of Los Angeles and Long Beach, rail yard facilities and/or along the major goods movement trade corridor in the region (Los Angeles/Inland Empire). The replacement of these older diesel trucks with natural gas vehicles resulted in reduced diesel air pollution and associated cancer risks to nearby communities. The project required the destruction of the older diesel trucks

---

<sup>1</sup>Ref.: Bob Fry, Fleet Municipal Sales Manager, Inland Kenworth

through scrapping and replacement with the new natural gas vehicles. The annual NO<sub>x</sub> and PM<sub>10</sub> emission reduction benefits from this project are identified below:

**Table 3: Emission Reduction Benefits**

<b>Project Description</b>	<b>Emission Reductions (tpy)</b>	
	<b>NO<sub>x</sub></b>	<b>PM<sub>10</sub></b>
132 Heavy-Duty Natural Gas Trucks	114	4.6

Source: California Air Resources Board's Truck Emission Benefits Calculator for the Proposition 1B – Goods Movement Emission Reduction Program (Year 2, Ver. 091511)

Due to the lower carbon content in natural gas fuel, this project reduced greenhouse gas emissions. Based on a report prepared by TIAX for the California Energy Commission<sup>2</sup>, the use of LNG or compressed natural gas (CNG) in heavy-duty vehicles will provide an 11 to 23 percent reduction in greenhouse gas emissions.

---

<sup>2</sup>“Full Fuel Cycle Assessment: Well-To-Wheels Energy Inputs, Emissions and Water Impacts”, June 2007

## CHAPTER 3

---

### Summary

In summary, the project resulted in the deployment of 132 new, heavy-duty natural gas trucks certified at or below the cleanest emission standards in California. These natural gas vehicles replaced older, high-polluting diesel trucks that were currently in use at the ports, nearby rail yard facilities, and/or along the main transportation corridors in the region. The project benefits include, but are not limited to, a reduction in diesel fuel consumption, diesel air pollution and associated cancer risk, and greenhouse gas emissions. For more information on the project benefits, please refer to the discussion under Results in Chapter 2. Furthermore, the project was successful in developing and disseminating information on alternative fuels and alternative fuel vehicle options to hundreds of truck owners/operators. The workshops were well-attended and demonstrated a need for continued outreach support as the technology advances and new alternative fuel information and vehicle options become available.

Another benefit of this project was the preservation and creation of jobs. This project received funding from the U.S. Department of Energy through the American Recovery and Reinvestment Act which was intended to stimulate the economy in an expeditious manner. Based on an informal survey and discussions with the natural gas truck manufacturers, it is difficult to estimate the number of jobs created by this project since this project represents a small percentage of the total number of natural gas trucks manufactured and deployed since 2009. The job growth occurred in the areas of plant production and assembly, supply base, field service and support, and sales and support. Other similar projects reported an estimated 1.2 to 1.3 jobs created for each heavy-duty natural gas truck deployed. Based on this research, this project involving the deployment of 132 heavy-duty natural gas trucks would have resulted in about 171 new jobs.

In addition, the project helped many independent owners/operators stay in business by providing a grant to reduce the incremental cost of purchasing a new, low-emission natural gas truck. With the phase out of older diesel trucks at the ports, many small fleets were faced with the difficult decision of buying a “used” diesel truck (engine model year 2007) with high mileage or going out of business due to the inability to afford a newer truck. Without the grant, many small fleets would have been forced to buy a used diesel truck to meet the port requirements or go out of business. The Energy Commission grant has helped many small fleets stay in business by subsidizing the cost of a new, ultra-clean natural gas truck.



# CHAPTER 4

---

## Conclusions and Lessons Learned

This project was largely successful due to the funding contributions by the California Energy Commission, U.S. Department of Energy, California Air Resources Board, Port of Los Angeles, Port of Long Beach and private stakeholders. This project demonstrated that natural gas is a viable fuel for heavy-duty trucks and can be used as a cleaner, domestically produced alternative to diesel fuel. The grant funds offered a sufficient incentive to truck owners/operators helping to overcome a market barrier for deployment. However, there were lessons learned that could offer improvements in the design and/or implementation of future incentive programs of this kind.

This project faced several barriers, including the higher cost of the natural gas vehicles, limited experience with natural gas technologies, limited infrastructure for re-fueling, concerns about reliability, dependence on a single natural gas engine manufacturer, the difficulty for drayage truck owners/operators to secure financing, and the long lead time for manufacturing of the natural gas vehicles.

The cost barrier was greatly reduced by the grant funding; however, fleet owners still had concerns about reliability and potential costs associated with any repairs/maintenance and downtime required for these activities. SCAQMD did receive some complaints related to the reliability of these trucks, specifically the 8.9L engine. To better understand the causes of these issues and promote solutions, SCAQMD conducted an outreach program to affected fleets, dealerships, truck and engine manufacturers, and fuel suppliers. Through this outreach, SCAQMD and technical consultants collected and analyzed reports of equipment failures, component defects, and extended repair times. Based on a detailed review of service records and conversations with engine and truck manufacturers, the equipment failure and components defects were identified to be due to contamination from charge air cooler (CAC) and several issues associated with the ISL-G engine. As such, truck and engine manufacturers provided proactive, extended warranty policy coverage to truck owners, and initiated a repair campaign to replace defective truck and engine components with newly redesigned components including CAC, transmission bell housing, turbine inlet temperature sensor, turbocharger housing/bushing, thermostats, exhaust manifolds, and exhaust gas recirculation coolers. This approach has resulted in a significant reduction in the number of service issues related to trucks powered by ISL-G engines. Fleets that do continue to experience engine-related issues are generally those using the trucks in very difficult duty-cycles associated with higher vehicle weights and longer periods of high speed operation. Cummins Westport and truck manufacturers have implemented all the lessons learned from this program in their trucks and newly certified ISX-12 G engines.

## ACRONYMS

American Recovery and Reinvestment Act (ARRA)

California Air Resources Board (CARB)

California Energy Commission (Energy Commission)

charge air cooler (CAC)

compressed natural gas (CNG)

Department of Energy (DOE)

emission factor - refers to series of models/tool for estimating mobile source emissions (EMFAC)

Proposition 1B-Goods Movement Emission Reduction Program Guidelines (Guidelines)

gross vehicle weight rating (GVWR)

liquefied natural gas (LNG)

natural gas (NG)

oxides of nitrogen (NO<sub>x</sub>)

miles per gallon diesel (MPG-d)

particulate matter (PM)

particulate matter measuring 10 microns or less (PM<sub>10</sub>)

South Coast Air Quality Management District (SCAQMD)

twenty-foot equivalent (TEU)

United States Environmental Protection Agency (U.S. EPA)

vehicle miles traveled (VMT)

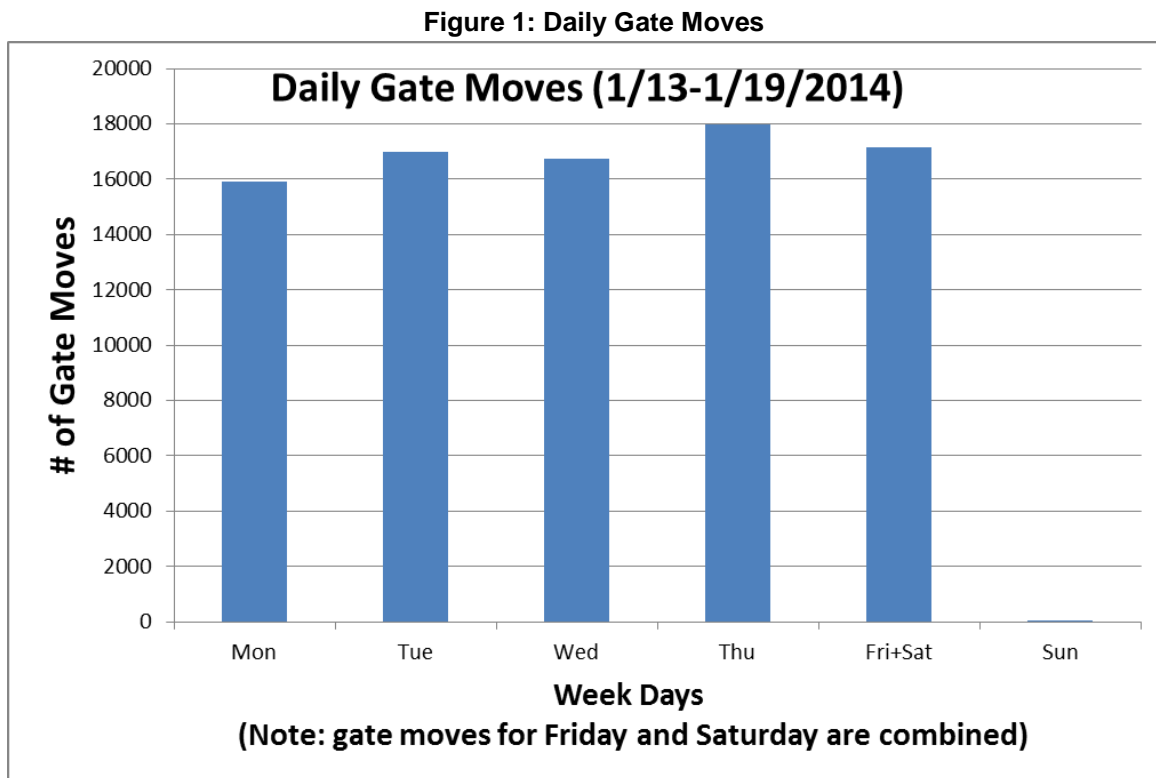
tons per year (tpy)

# APPENDIX A

---

## Methodology for Estimating Diesel Gallon Equivalent Replaced by Energy Commission Funded Natural Gas Trucks

1. Identify data availability including the post-inspection date, odometer reading on the post-inspection date, last date with available odometer readings, and reported mileage data.
2. For trucks with available data (date, odometer readings, etc.), calculate number of days for the available odometer readings, assuming 52 weeks\*5 working days/week or 260 working days in a year. The five working days assumption is based on the number of gate moves for each day of the week at the San Pedro Bay Ports (i.e., the Ports of Los Angeles and Long Beach). Please note that gate moves on Friday and Saturday combined are similar to weekday moves.)



Source: TetraTech Inc.

3. Assume the project end date is December 31, 2013 (Q4 2013). Calculate number of days from the post-inspection date to the project end date, using the same assumptions as described above.

4. Calculate Daily Average Vehicle Miles Traveled (Daily Average VMT) for each grant truck by dividing total miles reported by the number of days with reported miles.
5. Calculate Total Vehicle Miles Traveled by multiplying Daily Average VMT by number of days from the post-inspection date to the project end date.
6. Look up literature for average fuel economy data for Class 8 (Model Year 2010+ Heavy-Heavy Duty Diesel Drayage Trucks: 6 miles per gallon diesel (MPG-d) from the USEPA DEQ (Diesel Emissions Quantifier) model, and, 5.7 MPG-d from CARB EMFAC model. A default value of 6 MPG-d is used in estimating diesel replaced by LNG trucks for the same VMT. In addition, we have supporting documentation from CARB and EMFAC stating the following:
7. EMFAC 2011- Model Year 2010+ Heavy- Heavy Duty Diesel Drayage Truck near South Coast, fuel economy is 5.7 miles/gallons diesel.

**Figure 2: Proposed Fuel Economy Values for HHDDT Operating in California**

MY	MPG	Note
Pre-1988	5.20	100% Mechanically controlled engines (100% @ 5.2 mpg)
1988-1990	5.39	25% Phase-in of electronic control (75% @ 5.2 mpg and 25% @ 5.95 mpg)
1991-1993	5.58	50% Phase-in of electronic control (50% @ 5.2 mpg and 50% @ 5.95 mpg)
1994-1995	5.76	75% Phase-in of electronic control (25% @ 5.2 mpg and 75% @ 5.95 mpg)
1996	5.95	100% Phase-in of electronic control (100% @ 5.95 mpg)
1997-1998	5.95	Same Fuel Economy as MY 1996 engines
1999-2002	5.48	Post consent Decree Engines with 8% loss in Fuel Economy (Timing Retarding)
2003-2006	5.75	5% gain in Fuel Economy (Better Combustion Strategies)
2007	5.61	3% loss in Fuel Economy due to EGR + DPF (86% @ 5.58 mpg; 14% @ 5.75 mpg)
2008	5.59	3% loss in Fuel Economy due to EGR + DPF (93% @ 5.58 mpg; 7% @ 5.75 mpg)
2009	5.58	3% loss in Fuel Economy due to EGR + DPF (100% @ 5.58 mpg)
2010	5.78	4% gain in Fuel Economy due to SCR (90% @ 5.80 mpg and 10% @ 5.58 mpg)
2011	5.78	4% gain in Fuel Economy due to SCR (90% @ 5.80 mpg and 10% @ 5.58 mpg)
2012	5.80	4% gain in Fuel Economy due to SCR (100% @ 5.80 mpg)

Source: <http://www.arb.ca.gov/regact/2008/truckbus08/appg.pdf>

8. Calculating diesel replaced by LNG truck by dividing Total VMT by diesel fuel efficiency of 6 MPG to obtain diesel volume in gallons for each truck during the project period.

## APPENDIX B

---

### List of Heavy-Duty Natural Gas Trucks Funded by this Project

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
1399	Alto Xpress, Inc.	Pomona	CNG	318730	Kenworth	T800	\$223,376	\$37,000	0.9	0.03
1067-001	Arrowlink USA, Inc.	Wilmington	LNG	AX3289	Freightliner	M2-112	\$166,455	\$37,000	0.78	0.03
1067-002	Arrowlink USA, Inc.	Wilmington	LNG	AX3291	Freightliner	M2-112	\$166,455	\$37,000	0.77	0.02
474	BCI-Coca Cola Bottling Company of Los Angeles	Los Angeles	LNG	293967	Kenworth	Kenworth	\$161,832	\$25,000	0.09	0.01
475	BCI-Coca Cola Bottling Company of Los Angeles	Los Angeles	LNG	293968	Kenworth	T-440	\$161,832	\$55,000	0.09	0.01
1318	BNJ Trans	Wilmington	LNG	323385	Kenworth	T-440	\$163,640	\$37,000	0.96	0.05
1068	C.V. Ice Company, Inc.	Indio	CNG	BN3282	Freightliner	Business Class M2	\$164,626	\$37,000	0.9	0.03
364	California Cartage Co.(Adelso Hernandez)	Moreno Valley	LNG	325966	Kenworth	T-440	\$159,883	\$37,000	1.19	0.06

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
347	California Cartage Co.(Angel Garcia)	Costa Mesa	LNG	325964	Kenworth	T-440	\$159,883	\$37,000	1.75	0.05
358-1	California Cartage Co.(Camacho Gerardo Cedano)	San Dimas	LNG	325981	Kenworth	T-440	\$167,149	\$37,000	0.37	0.01
360	California Cartage Co.(Daniel Garcia)	Norwalk	LNG	325965	Kenworth	T-440	\$159,883	\$37,000	0.26	0.01
357	California Cartage Co.(Eracleo Castillo)	San Jacinto	LNG	325978	Kenworth	T-440	\$167,250	\$37,000	1.94	0.1
350	California Cartage Co.(Felipe Ugarte)	Whittier	LNG	325975	Kenworth	T-440	\$162,709	\$37,000	0.44	0.01
361	California Cartage Co.(Francisco Hernandez)	Long Beach	LNG	325967	Kenworth	T-440	\$161,040	\$37,000	0.47	0.06
354	California Cartage Co.(Jose Luis Sanabria)	Los Angeles	LNG	328155	Kenworth	T-440	\$166,898	\$37,000	1.05	0.03
341	California Cartage Co.(Jose Navarro)	Baldwin Park	LNG	325971	Kenworth	T-440	\$161,040	\$37,000	0.42	0.01

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
339	California Cartage Co.(Jose Palma)	Northridge	LNG	325972	Kenworth	T-440	\$159,883	\$37,000	0.76	0.1
352	California Cartage Co.(Juan Betancourt Ibarra)	Fontana	LNG	325968	Kenworth	T-440	\$161,100	\$37,000	1.13	0.06
355	California Cartage Co.(Julio C. Menjivar)	Colton	LNG	325970	Kenworth	T-440	\$159,883	\$37,000	0.66	0.02
338	California Cartage Co.(Julio Paredes)	Corona	LNG	325973	Kenworth	T-440	\$159,883	\$37,000	1.03	0.03
349	California Cartage Co.(Marco Antonio Gonzalez Perez)	Paramount	LNG	325980	Kenworth	T-440	\$167,250	\$37,000	1.12	0.04
368	California Cartage Co.(Miguel Bonilla)	Los Angeles	LNG	325977	Kenworth	T-440	\$167,250	\$37,000	2.01	0.06
351	California Cartage Co.(Oscar Portillo)	Los Angeles	LNG	325974	Kenworth	T-440	\$159,883	\$37,000	0.9	0.04
359-1	California Cartage Co.(Pablo A. Benavidez)	El Monte	LNG	331108	Kenworth	T-440	\$159,883	\$37,000	1.57	0.04

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
343	California Cartage Co.(Pedro Benavidez Lazo)	Hawthorne	LNG	326133	Kenworth	T-440	\$167,250	\$37,000	0.98	0.03
356	California Cartage Co.(Petronilo Laguna)	San Pedro	LNG	325969	Kenworth	T-440	\$159,883	\$37,000	0.79	0.04
342	California Cartage Co.(Roberto Diaz)	Baldwin Park	LNG	325979	Kenworth	T-440	\$167,250	\$37,000	0.58	0.02
345	California Cartage Co.(Roberto Gutierrez)	Long Beach	LNG	325963	Kenworth	T-440	\$161,100	\$37,000	0.81	0.03
344	California Cartage Co.(Rudy Vasquez)	Azusa	LNG	325976	Kenworth	T-440	\$159,883	\$37,000	0.74	0.04
1033	CSC Transport, INC	Torrance	LNG	A09345	Sterling	LT8500	\$134,595	\$37,000	1.48	0.05
1077-001	Disneyland Resort	Anaheim	CNG	322303	Kenworth	T400	\$200,085	\$37,000	1.21	0.03
1077-002	Disneyland Resort	Anaheim	CNG	322304	Kenworth	T400	\$200,085	\$37,000	1.01	0.03
600-003	Eight Star Commodities	El Centro	LNG	151892	Peterbilt	384	\$152,974	\$37,000	3.01	0.45



Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
600-001	Eight Star Commodities	El Centro	LNG	151890	Peterbilt	384	\$152,966	\$37,000	1.44	0.22
600-002	Eight Star Commodities	El Centro	LNG	151891	Peterbilt	384	\$152,974	\$37,000	1.34	0.21
1412	Hilda Garcia	Long Beach	LNG	325140	Kenworth	T-800	\$164,959	\$37,000	1.02	0.05
211	Hollandia Flowers, Inc.	Carpinteria	CNG	129992	Peterbilt	384	\$168,169	\$37,000	1.64	0.05
138-001	Kargo Transportation, Inc.	City of Commerce	CNG	AV7477	Freightliner	M2-112	\$164,141	\$37,000	1.26	0.04
900-006	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4063	Freightliner	M2-112	\$142,440	\$37,000	0.34	0.01
900-007	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4064	Freightliner	M2-112	\$142,440	\$37,000	0.94	0.03
900-051	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4060	Freightliner	M2-112	\$142,440	\$37,000	0.92	0.03

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-046	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4052	Freightliner	M2-112	\$142,440	\$37,000	0.91	0.03
900-004	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4062	Freightliner	M2-112	\$142,440	\$37,000	0.43	0.01
900-012	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4067	Freightliner	M2-112	\$142,440	\$37,000	4.06	0.12
900-052	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4056	Freightliner	M2-112	\$142,440	\$37,000	0.8	0.02
900-022	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4073	Freightliner	M2-112	\$142,440	\$37,000	0.74	0.02
900-054	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4051	Freightliner	M2-112	\$142,440	\$37,000	0.71	0.02
900-021	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4072	Freightliner	M2-112	\$142,440	\$37,000	0.71	0.02

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-014	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4068	Freightliner	M2-112	\$142,440	\$37,000	0.48	0.01
900-025	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4076	Freightliner	M2-112	\$148,598	\$37,000	0.67	0.02
900-034	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4081	Freightliner	M2-112	\$142,440	\$37,000	0.64	0.02
900-023	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4074	Freightliner	M2-112	\$148,598	\$37,000	0.62	0.02
900-015	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4069	Freightliner	M2-112	\$142,440	\$37,000	0.48	0.01
900-049	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4055	Freightliner	M2-112	\$142,440	\$37,000	0.6	0.02
900-020	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4071	Freightliner	M2-112	\$142,440	\$37,000	0.59	0.02

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-041	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4088	Freightliner	M2-112	\$148,598	\$37,000	0.59	0.02
900-030	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4078	Freightliner	M2-112	\$148,598	\$37,000	0.52	0.02
900-031	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4079	Freightliner	M2-112	\$142,440	\$37,000	0.56	0.02
900-033	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4080	Freightliner	M2-112	\$148,598	\$37,000	0.49	0.01
900-024	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4075	Freightliner	M2-112	\$148,598	\$37,000	0.52	0.01
900-036	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4083	Freightliner	M2-112	\$148,598	\$37,000	0.52	0.01
900-040	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4087	Freightliner	M2-112	\$148,598	\$37,000	0.69	0.02

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-016	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	FG5764	Freightliner	M2-112	\$148,598	\$37,000	0.48	0.01
900-042	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4049	Freightliner	M2-112	\$142,440	\$37,000	0.48	0.01
900-043	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	HB4050	Freightliner	M2-112	\$142,440	\$37,000	0.56	0.02
900-045	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4059	Freightliner	M2-112	\$142,440	\$37,000	0.82	0.02
900-047	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4057	Freightliner	M2-112	\$142,440	\$37,000	0.51	0.01
900-044	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4058	Freightliner	M2-112	\$142,440	\$37,000	0.46	0.01
900-035	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4082	Freightliner	M2-112	\$142,440	\$37,000	0.47	0.01

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-038	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4085	Freightliner	M2-112	\$148,598	\$37,000	0.45	0.01
900-056	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4054	Freightliner	M2-112	\$142,440	\$37,000	0.44	0.01
900-048	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4053	Freightliner	M2-112	\$142,440	\$37,000	1.2	0.03
900-037	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4084	Freightliner	M2-112	\$148,598	\$37,000	0.43	0.01
900-039	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4086	Freightliner	M2-112	\$148,598	\$37,000	0.41	0.01
900-009	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4065	Freightliner	M2-112	\$142,440	\$37,000	0.36	0.01
900-011	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4066	Freightliner	M2-112	\$142,440	\$37,000	0.35	0.01

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-050	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4061	Freightliner	M2-112	\$142,440	\$37,000	0.61	0.02
900-029	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BF4077	Freightliner	M2-112	\$142,440	\$37,000	0.32	0.01
900-032	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8735	Freightliner	M2-112	\$142,440	\$37,000	0.31	0.01
900-013	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8727	Freightliner	M2-112	\$142,440	\$37,000	0.28	0.01
900-028	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8733	Freightliner	M2-112	\$142,440	\$37,000	0.27	0.01
900-018	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8729	Freightliner	M2-112	\$142,440	\$37,000	0.28	0.01
900-055	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8734	Freightliner	M2-112	\$142,440	\$37,000	0.25	0.01

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
900-027	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8732	Freightliner	M2-112	\$142,440	\$37,000	0.25	0.01
900-026	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8731	Freightliner	M2-112	\$142,440	\$37,000	0.24	0.01
900-019	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8730	Freightliner	M2-112	\$142,440	\$37,000	0.22	0.01
900-017	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8728	Freightliner	M2-112	\$142,440	\$37,000	0.17	0
900-005	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8724	Freightliner	M2-112	\$142,440	\$37,000	0.14	0
900-008	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8725	Freightliner	M2-112	\$142,440	\$37,000	0.12	0
900-010	SYSCO Food Services of Los Angeles, Inc.	Walnut	LNG	BM8726	Freightliner	M2-112	\$142,440	\$37,000	0.1	0



Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
944-001	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2486	Freightliner	M2-112	\$163,295	\$37,000	1.75	0.05
944-002	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2487	Freightliner	M2-112	\$162,993	\$37,000	2.08	0.07
944-003	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2488	Freightliner	M2-112	\$162,993	\$37,000	1.18	0.18
944-004	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2489	Freightliner	M2-112	\$162,993	\$37,000	1.37	0.04
944-005	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2490	Freightliner	M2-112	\$162,993	\$37,000	2.09	0.07
944-006	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2491	Freightliner	M2-112	\$162,993	\$37,000	1.59	0.05
944-008	Total Transportation Services, Inc.	Rancho Dominguez	LNG	BU2492	Freightliner	M2-112	\$162,993	\$37,000	1.6	0.05

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
14-RPM059	RPM Transportation, Inc.	Santa Fe Springs	LNG	BS0687	Freightliner	M2	\$157,175	\$37,000	1.9	0.05
2-76	Eagle Transportation LLC.	Grand Terrace	LNG	BR8641	Freightliner	M2112	\$181,400	\$29,000	1.39	0.05
5-263528	United Parcel Service Inc.	Laguna Hills	LNG	365326	Kenworth	T8	\$232,256	\$37,000	1.3	0.04
14-RPM056	RPM Transportation, Inc.	Santa Fe Springs	LNG	BS0684	Freightliner	M2	\$157,175	\$37,000	1.4	0.03
15-6525	Anthony H. Osterkamp Jr.	Orange	LNG	355767	Kenworth	T-8W	\$175,072	\$37,000	1.37	0.03
5-263521	United Parcel Service Inc.	Laguna Hills	LNG	365327	Kenworth	T8	\$232,256	\$37,000	1.2	0.04
14-RPM061	RPM Transportation, Inc.	Santa Fe Springs	LNG	BS0688	Freightliner	M2	\$157,175	\$37,000	1.35	0.03
14-RPM057	RPM Transportation, Inc.	Santa Fe Springs	LNG	BS0685	Freightliner	M2	\$157,175	\$37,000	1.23	0.03

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
15-3558	Anthony H. Osterkamp Jr.	Orange	LNG	355773	Kenworth	T-8W	\$175,072	\$37,000	0.74	0.05
8-3248	Transportation Commodities, Inc.	Fontana	CNG	FG5813	Freightliner	M-2	\$136,125	\$48,500	0.98	0.02
14-RPM062	RPM Transportation, Inc.	Santa Fe Springs	LNG	FF4616	Freightliner	M2	\$157,175	\$37,000	1.18	0.03
5-263571	United Parcel Service Inc.	Laguna Hills	LNG	365328	Kenworth	T8	\$232,256	\$37,000	1	0.03
15-3575	Anthony H. Osterkamp Jr.	Orange	LNG	355768	Kenworth	T-8W	\$175,072	\$37,000	0.7	0.05
8-3230	Transportation Commodities, Inc.	Fontana	CNG	FG5817	Freightliner	M-2	\$136,125	\$42,000	0.91	0.02
15-3563	Anthony H. Osterkamp Jr.	Orange	LNG	355772	Kenworth	T-8W	\$175,072	\$37,000	0.69	0.05
14-RPM064	RPM Transportation, Inc.	Santa Fe Springs	LNG	FF4618	Freightliner	M2	\$165,638	\$37,000	1.09	0.03
5-263569	United Parcel Service Inc.	Laguna Hills	LNG	365329	Kenworth	T8	\$232,256	\$37,000	0.95	0.03

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
15-211	Anthony H. Osterkamp Jr.	Orange	LNG	355770	Kenworth	T-8W	\$175,072	\$37,000	0.97	0.03
15-13106	Anthony H. Osterkamp Jr.	Orange	LNG	361764	Kenworth	T-800	\$177,293	\$37,000	1.08	0.03
10-103642	Sysco Food Services of Los Angeles	Walnut	LNG	FG5748	Freightliner	M2	\$146,221	\$45,000	0.82	0.02
5-263531	United Parcel Service Inc.	Laguna Hills	LNG	365330	Kenworth	T8	\$232,256	\$37,000	0.94	0.03
5-263526	United Parcel Service Inc.	Laguna Hills	LNG	365331	Kenworth	T8	\$232,256	\$37,000	0.94	0.03
5-263533	United Parcel Service Inc.	Laguna Hills	LNG	365332	Kenworth	T8	\$232,256	\$37,000	0.93	0.03
5-263570	United Parcel Service Inc.	Laguna Hills	LNG	365333	Kenworth	T8	\$232,256	\$37,000	0.9	0.03
5-263563	United Parcel Service Inc.	Laguna Hills	LNG	365334	Kenworth	T8	\$232,256	\$37,000	0.88	0.03
15-207	Anthony H. Osterkamp Jr.	Orange	LNG	355769	Kenworth	T-8W	\$175,072	\$37,000	0.89	0.03

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
14-RPM058	RPM Transportation, Inc.	Santa Fe Springs	LNG	BS0686	Freightliner	M2	\$165,638	\$37,000	0.98	0.02
15-6573	Anthony H. Osterkamp Jr.	Orange	LNG	355771	Kenworth	T-8W	\$177,293	\$37,000	0.61	0.04
10-103759	Sysco Food Services of Los Angeles	Walnut	LNG	FG5747	Freightliner	FLD	\$146,221	\$3,110	0.59	0.01
14-RPM053	RPM Transportation, Inc.	Santa Fe Springs	LNG	FF4617	Freightliner	M2	\$165,638	\$37,000	0.97	0.02
10-103761	Sysco Food Services of Los Angeles	Walnut	LNG	FG5750	Freightliner	FLD	\$146,221	\$45,000	0.53	0.01
15-210	Anthony H. Osterkamp Jr.	Orange	LNG	360099	Kenworth	T-800	\$175,072	\$37,000	0.83	0.03
15-13111	Anthony H. Osterkamp Jr.	Orange	LNG	361765	Kenworth	T-800	\$175,072	\$37,000	0.93	0.02
10-103762	Sysco Food Services of Los Angeles	Walnut	LNG	FG5755	Freightliner	FLD	\$146,221	\$45,000	0.47	0.01

Project ID#	Company Name	City	Fuel Type	VIN (last 6 digits)	Make	Model	Total Truck Price	CEC Funding	NO <sub>x</sub> (tpy)	PM (tpy)
10-103641	Sysco Food Services of Los Angeles	Walnut	LNG	FP6513	Freightliner	Cascadia	\$146,221	\$27,000	0.46	0.01

Source: South Coast Air Quality Management District Staff